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## WEATHER CONTROLS OVER THE FIGHTING DURING THE SPRING OF 1918

By Professor ROBERT DeC. WARD

HARVARD UNIVERSITY

THE military operations of the present spring (1918) have been of such critical importance in relation to the probable outcome of the whole war that all factors which have played any part in the fighting deserve careful attention. In the following article, the part played by meteorological controls is set forth as fully as is possible at this time. The facts here included have been collected from the regular official despatches, and from the reports of reliable war correspondents and military experts. It is obviously not possible, as yet, to do full justice to the subject, and some of the facts here included may need revision when fuller information becomes available.

Throughout the late winter and the first three weeks of spring, the probable date of the expected German offensive was a matter of momentous interest. No really active winter campaigns have been carried on in the western war zone. As a whole, the season of aggressive military operations has been April to November. In 1915, the spring campaign may be said to have begun on April 22. In 1916, the German Verdun drive was begun in late February (21st), at a season meteorologically unfavorable, in order, probably, to forestall the expected British and Russian spring drives. In 1917, the British inaugurated their offensive about Arras on April 9. Spells of warm, thawing weather characteristically come with increasing frequency in March and April, but unless the season is "early," major operations are more than likely to be held up by storms and bad roads until spring is well established. During last February (1918) there were, as usual, fogs, heavy rains and bad roads, but the increasing number of fine, warm days, accompanied by drying ground, caused the Allied commanders to expect an early German offensive. March "came in like a lion," with gales and snowstorms; heavy rains and cold, and then followed alternating spells of fine and warm, and of cold and stormy weather.

The great German offensive began on the early morning of March 21. From all the evidence that has so far come to hand

it is clear that the time must have been carefully chosen after consultation with the meteorological experts. It was a spell of fine, dry weather ("exceptional weather favored his [the enemy's] designs"), and dry weather is one great essential, especially in the low country on the Western front, for the rapid movement of troops, of ammunition and of supplies. With heavy rains, deep mud and impassable roads, no quick, effective advance can be made. A dry spell in western Europe usually means that there is a well-developed area of high pressure to the eastward. This type of weather, when well established, is not unlikely to last for several days, longer, as a rule, than dry spells usually last in the early spring in the eastern United States. In western Europe, such spells bring easterly winds, which are often chilly, and also night fogs. Easterly winds are, furthermore, obviously favorable for the use of gas by the enemy, and also carry the smoke of artillery firing to the west, thus helping to screen the attacking troops.

Such conditions, easily inferred by any meteorologist who has a knowledge of European weather types, prevailed during the first ten days of the German offensive. All the meteorological factors were in favor of the enemy. The attack began in a thick fog along much of the front. The enemy advanced in many places unseen by the Allied troops, the smoke cloud also helping to serve as a screen. Gas was successfully used in various localities. The Allied gunners could hardly see their own horses; the firing had to be more or less haphazard; the infantry was obliged to advance without adequate artillery preparation. The surprise of the British 5th Army was largely attributed to the fog. Airplane observation was difficult along much of the front. In some places the fog evidently threw the assaulting German troops into confusion, the different units being temporarily unable to join forces as had been planned. As was to be expected, the easterly winds soon became colder, and the troops were reported as needing heavy overcoats, especially at night.

This spell of fine dry weather lasted, with but a few local and temporary interruptions in the way of showers or snow flurries, for a little over a week, but it was a week during which the enemy was able to make very considerable progress. Then heavy rains set in, continuing off and on, in spells, as is usual in the spring in Flanders. The Germans were at once greatly handicapped because of the difficulties of moving their troops, artillery and supplies through the deep and sticky mud. The weather conditions were then in favor of the Allies. The Ger-

mans had simply outrun their guns. There was some respite from the incessant German attacks, and there was time to perfect plans and to strengthen defenses. The mud did not hamper the Allies as much as the Germans, because the roads back of the Allied lines had not been so badly broken up by the gun-fire. The German papers mentioned the handicaps resulting from the rains, and explained the slackening of their offensive as being due to the weather. There is no reason to doubt that this was at least in part the case. It is clear that the condition of the roads, especially when the distance from their starting point was taken into account, made it unwise, if not impossible, for the Germans to continue their attempt at that time to break through between the British and French armies. The heavy rains may have played a more important part than many people imagine.

During the renewed German offensive, early in the second week of April, the enemy again took advantage of a thick early morning fog, during a dry spell, when the ground was hard. It was quite impossible for the Allied troops to see the enemy until the latter was very close to the front lines.

The April despatches make frequent mention of alternating spells of rainy and of fine, sunny weather; and of many German surprise attacks made in fogs (as, *e. g.*, at Mt. Kemmel on April 26), which are very frequent at all seasons on the western front. During the first week of April several days of rain brought a general suspension of major operations. Mr. F. H. Simonds, in his weekly account of the war, wrote:

Perhaps if it had not rained he (the enemy) might have gotten through, just as Victor Hugo and other French writers insist that Napoleon would have won at Waterloo if it had not rained the night before, and delayed the French attack the next morning.

The dry spells were at once taken advantage of by the aviators for reconnaissance work and for bombing, and by the Germans, for renewed attacks. On April 20 there were reports of belated snow-squalls, and of inclement weather, accompanied by a temporary lull in the fighting. An interesting illustration of the marked attention paid by the Germans to meteorological conditions is found in the arrangements for moving troops in different weather conditions. According to press despatches,

Orders are issued under which in the first zone, on clear days, foot troops may not move in any greater number than four men together, mounted men not more than two together, and vehicles not more than one at a time, with a minimum distance of 300 yards between groups. The

restrictions are relaxed when the weather is not clear, so as to permit the movement of groups of forty infantrymen, twenty cavalrymen, and ten vehicles. In the second zone it is permissible to form groups of the size allowed in the first zone on hazy days, but there must be intervals of 500 yards. In this manner movements generally escape attention.

Heavy rains fell on several days early in May; the roads were in very bad condition; shell-holes and all depressions were filled with water. That the expected renewal of the German drive was thereby delayed is undoubted. It is to be expected that, when so much depends upon the most favorable combination of all possible elements which may make for success, the enemy will wait for favorable weather conditions before attempting a general attack. To advance when the quick movement of reserves, of guns, of ammunition and of supplies is impossible, owing to the condition of the roads, is to run a very unnecessary risk. Several days of very fine weather, reported after the middle of May, were not accompanied by a renewal of the German offensive. One correspondent suggested that what the enemy wanted was misty, foggy conditions, such as he chose at the beginning of the first great advance on March 21. A Paris despatch, May 18, also intimated that "the beginning of the offensive by which the Germans expect to achieve final success now depends solely on weather conditions."

There is no doubt that the enemy took advantage of every spell of fine weather to improve his roads, and to bring up supplies and ammunition. One of the best-informed of the war correspondents, Mr. Philip Gibbs, wrote under date of May 24:

Heavy rainstorms have broken up the fine spell of sunshine which made this May so splendid. This change does not fill us with regret, because dirty weather now may be in our favor, and hinder the enemy in his offensive schemes. . . . Bad weather, however, acts against both sides, and though they (the Germans) should be held fast in the mud, the British do not want to lose visibility for their flying men or machine gunners. . . . The enemy is very cunning in making use of climatic conditions, and adapts his methods to them.<sup>1</sup>

Berlin despatches, dated May 25, stated that the bad weather was preventing active operations.

The German offensive was renewed on May 27. At the time of sending the present article to the press, very few details regarding the meteorological conditions are available. So far as information has come to hand, it appears that the weather was fine, with bright moonlight at night. One Berlin despatch, of May 29, notes changeable weather. The delay in opening this new offensive has been ascribed, by one correspondent, to the

<sup>1</sup> New York Times, May 25, 1918.

desire of the Germans to postpone their attack until better weather conditions in the Trentino sector should make it possible for the Austrians to begin their offensive in that area.

There have been several interesting occurrences in connection with the use of gas. On April 10, four regiments of Prussian Guards were reported as having suffered severely during an attack on Armentières, when the wind shifted suddenly, and blew their gas back in their own faces. On May 12, another similar case was reported, the enemy becoming disorganized in consequence. A Swiss report dated Geneva, May 7, noted that the municipal authorities at Mülhausen, in Alsace, had ordered all inhabitants to obtain gas masks as a protection "against aerial gas attacks." The statement added that, owing to the prevalence of westerly winds, great quantities of the poisonous gases used by the Germans on the western front had drifted east, toward the Rhine. This story is hardly credible, for the gases are rapidly diffused and diluted when carried far by wind. It is worth noting that the Germans are now using gases in four ways. First, gas clouds, which depend on a favorable wind; second, projectors, which also depend on the wind; third, long-range artillery gas shells; and fourth, hand grenades. The direction and velocity of the wind enters as a critical factor in the first two cases. In connection with gas attacks of the first sort a good deal of information is now available. We know that the German "gas regiments" contain a considerable number of trained meteorological observers, who watch the current weather conditions. While the gas goes with the wind, it is clear that topography plays a part in its diffusion, which is best in a flat country, and poorest in a broken country. A recent writer, Major S. J. M. Auld, has told us that the outline of the trench system and the angle at which the wind is blowing are carefully correlated, in order that the gas shall not be driven back into any part of the German trenches. A "factor of safety" is determined for the angle between the wind direction and the line of the trenches. Ordinary gas attacks are not made when the wind direction is within about  $45^{\circ}$  of any trench within gassing distance. Further, details as to the most favorable wind velocity have been forthcoming. If the wind is too strong, the gas is dispersed, or moves too fast. If the wind is too light, it takes the gas too long to cross "No Man's Land." Very light winds are also more likely to change their direction than stronger winds, and may blow the gas back into the German lines. The best winds blow between 4 and 12 miles an hour. A wind of 8 miles carries the gas cloud about twice as

fast as a man moves away who retreats rapidly. It is perfectly clear that the German meteorologists have made very careful study of wind and weather before launching such gas attacks, and their success, in a large majority of cases, shows how well their weather forecasts were made.

From the eastern front there is naturally very little to report. Here it was the ice—the result of the cold winter of the Baltic and its adjacent gulfs—that played a part. A Petrograd despatch, dated March 15, noted the movement of 3,000 German troops from the Aland Islands to the coast of Finland in transports, preceded by an ice-breaker. A later despatch (April 7) reported that the Germans were marching from the Aland Islands across the ice at the mouth of the Gulf of Bothnia towards Abo, on the coast of southern Finland, and that the arrival of the German fleet off the Finnish coast threatened the safety of the Russian ships at Helsingfors, which were unable to escape owing to the lack of an ice breaker. A British Admiralty statement, issued May 16, noted that several British submarines were frozen solidly in the ice in the harbor of Helsingfors at the time when the German naval forces were approaching. It was suggested that the ice be broken up around the submarines, and that they should then attempt to dive under the ice and reach open water outside the harbor. After careful consideration of this plan, the British commanders decided that it was impracticable. The submarines were therefore blown up.

There has been a good deal of discussion, since the war began, regarding the most favorable season for submarine activity. Opinions have differed on this question. At present, naval opinion in Washington seems to be that the season makes little difference. The smoother water and the longer daylight of summer are an advantage during that season, but these may be offset by the better opportunity which the submarines have, during the long winter nights, to come to the surface to recharge their batteries, to rest their crews, and to make long trips unsubmerged, thereby increasing their effective area.

It was not to be expected that there would be any considerable activity in the Trentino sector of the Italian front until well along into the spring. The deep winter snows of that rugged mountainous region are unlikely, under ordinary conditions, to melt sufficiently to make active campaigning possible until May, or perhaps even early June. Heavy snowfalls were reported early in March. On March 18 an Associated Press despatch noted that "the snow along the mountain fronts has been reduced considerably by mild weather recently, but

the amount remaining is still sufficient to retard extensive operations." On the Piave front spring freshets made the stream "too wide and deep for crossing by considerable bodies of troops." Late in April (28th and 30th) severe winter weather prevailed along the Italian front, heavy snowfalls (6 feet deep in places) and "blizzards" being reported in the Alpine sector, and intense cold on the Venetian plain. Several days of torrential rain had swollen the Piave and Adige Rivers. Such conditions made an Austrian offensive impossible, the snow having obstructed the roads, and rendering the movement of the enemy troops very slow and difficult.

The delay caused by the snow and the general atmospheric conditions permits the Italians to complete their defensive works, and add to their reserves of guns and ammunition.<sup>2</sup>

Shortly before the middle of May (10th) the Italians began the spring campaign, after a long period of winter inactivity, by capturing the dominating position of Monte Corno, a summit reported as 6,000 feet high, and still snow-covered. The topography and the snow presented great difficulties to the Italian troops, but the enemy was taken by surprise and a considerable number of Austrians were made prisoners. The advance of spring, accompanied by the melting of the snows and more favorable weather, led to the expectation, on the part of the Italians, of a speedy inauguration of the expected Austrian offensive. A Rome despatch, dated May 20, was as follows:

The only obstacle which prevents an enemy attack immediately is the weather, which this year continues to be rainy, foggy, and even cold in some of the higher regions, with continual hailstorms. But the weather is becoming undeniably milder. The snow is beginning to melt, while avalanches often bury the emplacements and the huts which have been excavated.

During the last days of May, the Italians won a brilliant victory in the Tonale region, some 12,000 feet above sea level, northwest of Trent. The ground was still covered with snow, and the fighting was among glaciers.

In Palestine the British continued their advance. The weather was still on the whole favorable for military operations, the heat and drought of the summer not yet having really set in. An interesting illustration of the part played by local meteorological phenomena occurred on March 16, 78 miles northwest of Medina, when, under cover of a sandstorm, a company of the Turkish Camel Corps was surprised and destroyed.

<sup>2</sup> Rome despatch to Italian Embassy in Washington, May 4.

Both duststorm and Camel Corps bear witness to the climate of the region in which this incident took place.

In Mesopotamia there has been considerable activity. After months of preparation, the British have lately been advancing northward along both the Tigris and the Euphrates Rivers, the objective being Mosul, an important Turkish base. The hottest and driest season of the year is rapidly approaching, both in Palestine and in Mesopotamia, and major operations are not likely to be carried on in either country unless there is absolute necessity for the continuance of an active campaign. A report dated May 7 mentioned a heavy rain near Kerkuk (Mesopotamia). Such rainfalls are improbable again until the next winter rainy season sets in, after the almost intolerable heat of the summer and autumn is over. Major-Gen. Sir Frederick Maurice, in his war summary of May 24, said that

Not the least of the advantages we have gained by our recent efforts is that we occupied a portion of the Persian foothills, which give a healthier country for the summering of our troops than the plains of Bagdad afford.

At sea, the weather factor has played a considerable part. In the daring raid on the German naval bases at Zeebrugge and Ostend (April 22), Admiral Keyes, according to the reports, waited for "certain conditions of wind and weather" before he gave orders for his fleet to cross the Channel. What the British wanted was a weather type which should combine an ordinary ocean fog with winds favorable for the use of a smoke curtain for purposes of concealment. The British vessels advanced under a dense smoke screen, aided later by a fog. Aerial work was necessarily interfered with. A clear and concise press report of the operations is as follows:

The losses of the Zeebrugge raiders were due almost entirely to a shift of the wind, which prevented the complete success of the smoke screen. Fortunately, the wind held in the right direction long enough to enable the *Vindictive* and her consorts to approach the mole, but changed and dissipated the screen as the men landed. This enabled the Germans to find targets.

At Ostend the shift of the wind came a little earlier and upset the plans of attack. Small craft with smoke apparatus ran in according to program and set up a screen. Then they lit two large flares to mark the entrance of the harbor for the concrete cruisers. Unfortunately, before these could get up, the screen was blown away and the German gunfire quickly destroyed the flares. This left our cruisers with nothing to guide them, and though they tried to proceed by guesswork under heavy fire, these gallant efforts were in vain.

According to Sir Eric Geddes, the difficulties at Ostend

were "considerably increased by mist, rain and low visibility, and the consequent absence of aerial cooperation." The Italian naval exploit at Pola, which resulted in the destruction of an Austrian dreadnaught, was favored by a very dark night, and an offshore wind, which prevented the sounds of preparation from being carried landward.

The war in the air is being carried on with steadily increasing intensity. Aviators are flying in weather conditions—rain and snow storms; gales and mists—which were only very lately regarded as prohibitive. As aerial warfare continues on the western front, the disadvantage under which the Allied flyers labor because of the prevailing westerly winds are receiving more and more emphasis. As a well-known aviator has recently expressed it, "if an airman ever wishes for a favorable wind it is when he is breaking for home. . . . These westerly gales were one of the worst things we had to contend with at the Front. They made it very easy for us to dash into enemy territory, but it was a very different story when we started for home and had to combat the tempest." In connection with general air raids, several points are worth noting. On March 11 nine squadrons of German airplanes attacked Paris during a fog, which "was thick enough to cause the general belief that there was little chance that the Germans would attempt an air raid." It may very likely have been for this reason that these weather conditions were selected. A German raid on Hull and its vicinity on March 13 was also "completely unexpected. The night was dark, and a slight drizzle was falling." This raid, and others, have shown that the German aviators no longer depend on moonlight. Early in March, the Germans made their first night air-raid on London when there was no moon. The stars were out, however, and there was little wind. On May 19 another raid was made on a very clear night, when the moon was shining. On April 12 a German air raid on Paris was made on a "still, dark night, of the sort most favorable for an aerial attack, and a raid was generally expected." And on May 21, during another raid, the night was clear and calm, with a brilliant moon, "ideal for an aerial attack."

In connection with the work of the German army meteorological service, it has, since the beginning of the war, been a matter of some interest to know how the enemy obtains the observations, especially from the western coast of Ireland, which are very necessary in constructing weather maps and in making forecasts. Captured documents show that their meteorological reports are fairly complete, despite the fact that no pub-

lication of weather data or forecasts is permitted in English newspapers. An English meteorological expert declares that the answer to the question is not through any system of spies and land wireless, but that the data are obtained from observations taken by submarines. He thinks that a submarine working off the western Irish coast is detailed to send weather reports to Germany by relays through the wireless apparatus working around the British Isles.

In the African war zone, where so many political changes have taken place but from which so little direct information has come, the spring months have witnessed an advance of the allied troops on the remnants of the German forces which escaped from German East Africa to Portuguese East Africa. An official despatch dated London, April 11, says:

In Portuguese Nyassaland, despite the difficulties caused by heavy rains and flooded rivers, our columns from the coast and from Lake Nyassa are approaching Medo and Msalu, respectively, and their advanced troops are in contact with those of the main enemy forces concentrated in these localities.

A later report (April 27) from the British War Office stated:

Since April 17 the convergent advance of General Northey and General Edwards's troops has proceeded under better weather conditions. The main enemy force is in the vicinity of Namungo. British and Portuguese troops are moving in the direction of Msalu River, while further south other British and Portuguese columns have been disposed north and south of the River Lurio.